

# **Study to Evaluate Potential Effects of Ammonia on Delta Smelt**

**Status Update – 30 July 2008**

A previous web posting<sup>1</sup> summarized background information about issues related to ammonia in the Sacramento-San Joaquin Delta estuary. As indicated in that posting, the Regional Water Board contracted with researchers at the University of California, Davis Aquatic Toxicology Laboratory to initiate studies to evaluate the potential effects of ammonia on delta smelt. The study was designed to answer two questions:

1. Is delta smelt survival negatively impacted by ambient ammonia concentrations in the Sacramento River with increasing concentrations causing increased mortality?
2. Is delta smelt survival negatively impacted by one or more contaminants present in the Sacramento Regional Wastewater Treatment Plant (SRWTP) effluent that are positively correlated with ammonia?

The study plan identified two sets of experiments to be conducted with the first set beginning in June 2008. To date, researchers have conducted two tests: one to determine the 4-day delta smelt ammonia LC50 in laboratory water (i.e., establish the concentration of ammonia that would cause 50% of the test fish to die) and the first set of ambient tests using the SRWTP effluent as a source of ammonia. In the LC50 test the concentration of total ammonia at which no effect could be detected was 5 mg/L, the lowest concentration that produced an effect was 9 mg/L, and the LC50 was calculated at 12 mg/L. These results suggest that delta smelt are about as sensitive to ammonia as some of the more sensitive species (e.g., salmon and trout) and therefore, that the USEPA acute ammonia criteria used by the Regional Board in NPDES permitting would be protective of delta smelt. Average ammonia concentrations in the Sacramento River also are lower than the chronic effect levels for fish species reported in the USEPA dataset.

The ambient set of tests were conducted in Sacramento River water collected upstream of the SRWTP discharge at concentrations of ammonia that encompassed average concentrations in the River once the effluent is fully mixed downstream. To evaluate whether any other toxicants could be present in the SRWTP effluent that effect delta smelt (question #2), the tests were conducted using laboratory ammonium chloride (ranging from 0.25 to 4.0 mg/L) and SRWTP effluent (ranging from 0.25 to 2.0 mg/L) as a source of ammonia. No effect was observed at any of the ammonia concentrations. These results are consistent with the laboratory LC50 study and indicate that the SRWTP effluent is not acutely toxic to Delta smelt at concentrations four times greater than the average currently observed in the Sacramento River, and five times greater than the average effluent concentration now present in the Sacramento River.

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<sup>1</sup>The referenced document is available for download at:  
[http://www.waterboards.ca.gov/centralvalley/water\\_issues/delta\\_water\\_quality/ammonia\\_issues/ammonia\\_issues\\_11jun08.pdf](http://www.waterboards.ca.gov/centralvalley/water_issues/delta_water_quality/ammonia_issues/ammonia_issues_11jun08.pdf)

After reviewing the initial results, Regional Water Board staff, in consultation with UC Davis researchers, SRWTP, and the review team<sup>2</sup>, planned modifications to the study design to further evaluate question #2. - The new objective is to quantify the potential interactions between effluent and ammonia toxicity to delta smelt (i.e., does the effluent add to, decrease, or have no effect on toxicity). The second set of tests will include some of the same concentrations of ammonia that were tested previously to verify the results of the first set of tests. In addition, higher concentrations, closer to the level that produced effects in the LC50 study, will be tested to evaluate question #2 and to assess the potential for effluent and ammonia interactions. It should be noted that these concentrations are well above levels that occur in the Sacramento River downstream of the SRWTP discharge. This second set of tests will be conducted in July 2008.

It is important to note that these studies only assess the acute (i.e., short-term, lethal) effects of ammonia on delta smelt immediately downstream of the SRWTP discharge location in the Sacramento River. Questions remain about the potential for chronic (i.e., long-term, sub-lethal) impacts from ammonia as well as the impacts in sensitive delta smelt spawning areas downstream of the SRWTP discharge. Future studies may need to be designed to answer these questions.

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<sup>2</sup> The Interagency Ecological Program Contaminants Work Team served as the technical review panel for these studies.